Spatial and Temporal Analysis of Red Light Running Citations and Crashes in Lincoln, Nebraska

Chenhui Liu[1], Sunil Gyawali[2], Sharma Anuj[1], Edward Smaglik[3]

[1]Department of Civil, Construction and Environmental Engineering, Iowa State University, Ames, IA

[2]Department of Civil Engineering, University of Nebraska-Lincoln, Lincoln, NE

[3]Department of Civil and Environmental Engineering, Northern Arizona University, Flagstaff, AZ

Background

➢ Red light running (RLR) is a dangerous traffic violation.
➢ Officer enforcement is the main law enforcement method of discouraging RLR in Nebraska.
➢ The comparison of the distributions of citations and crashes can reflect the effectiveness of the RLR law enforcement.

Research Objective

➢ To analyze if the distributions of RLR citations and crashes are consistent in space and time.

Methodology

➢ Spatial analysis: Bivariate Moran's I and LISA using GeoDa.
➢ Temporal analysis: radar plot.
➢ Spatio-temporal analysis: Kulldorff's space-time permutation scan statistic using SaTScan.
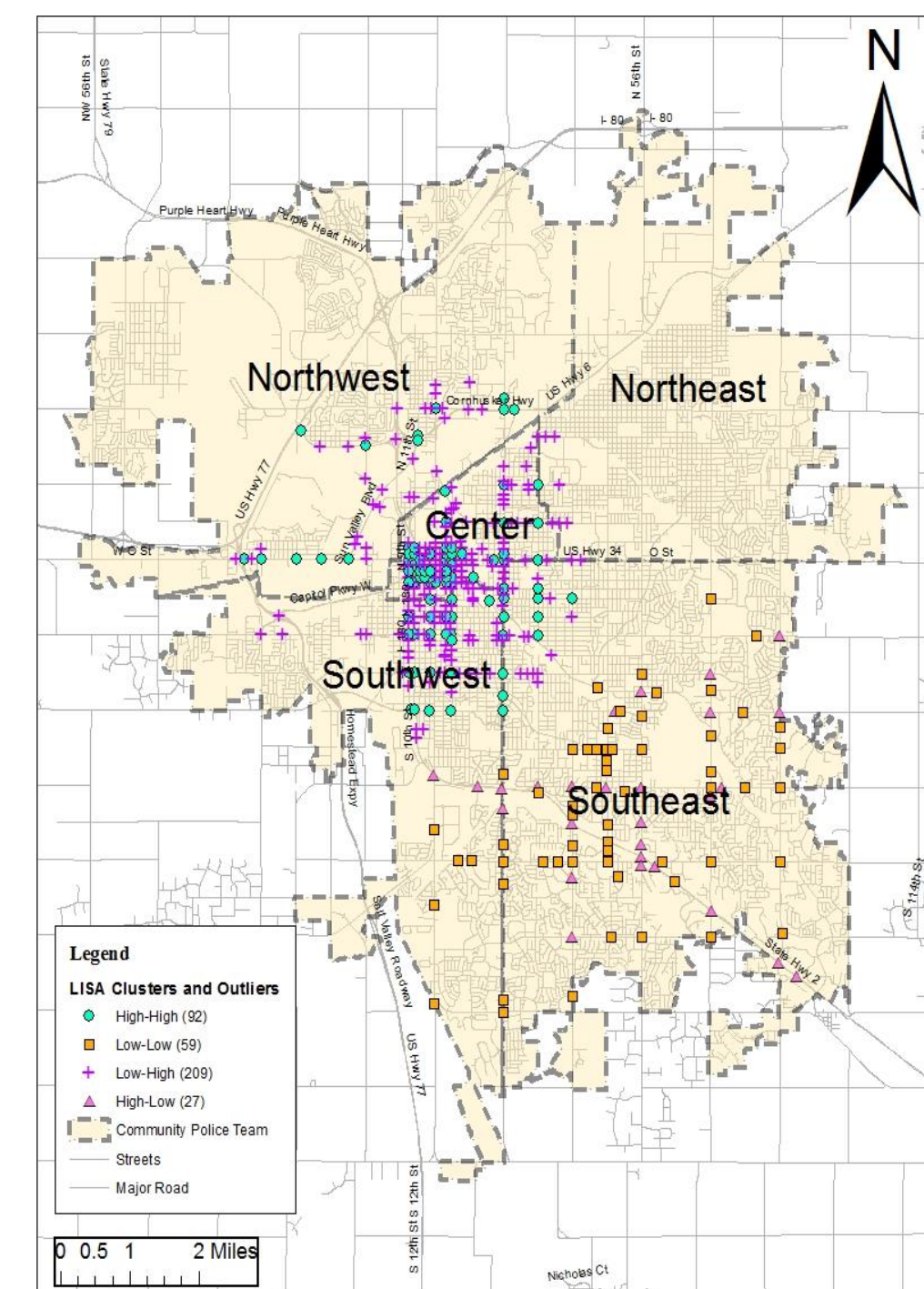
Data Collection

2007-2013 RLR citation and crash data in Lincoln, NE.

Type	Citation	Crash
Sum	7676	1454
Intersections	562	314

Data Analysis – Spatial Analysis

Scatterplot of bivariate Moran's I of citations and crashes
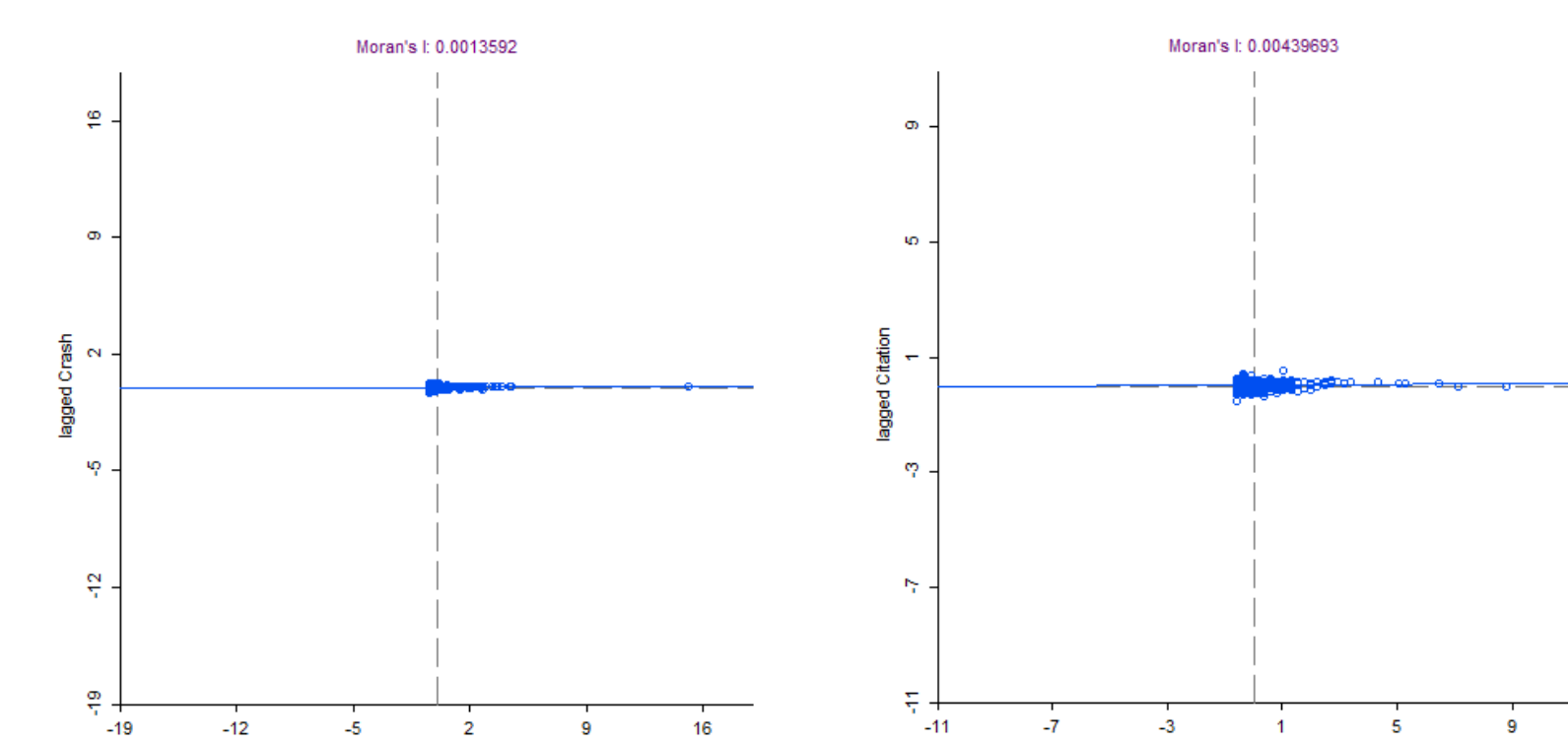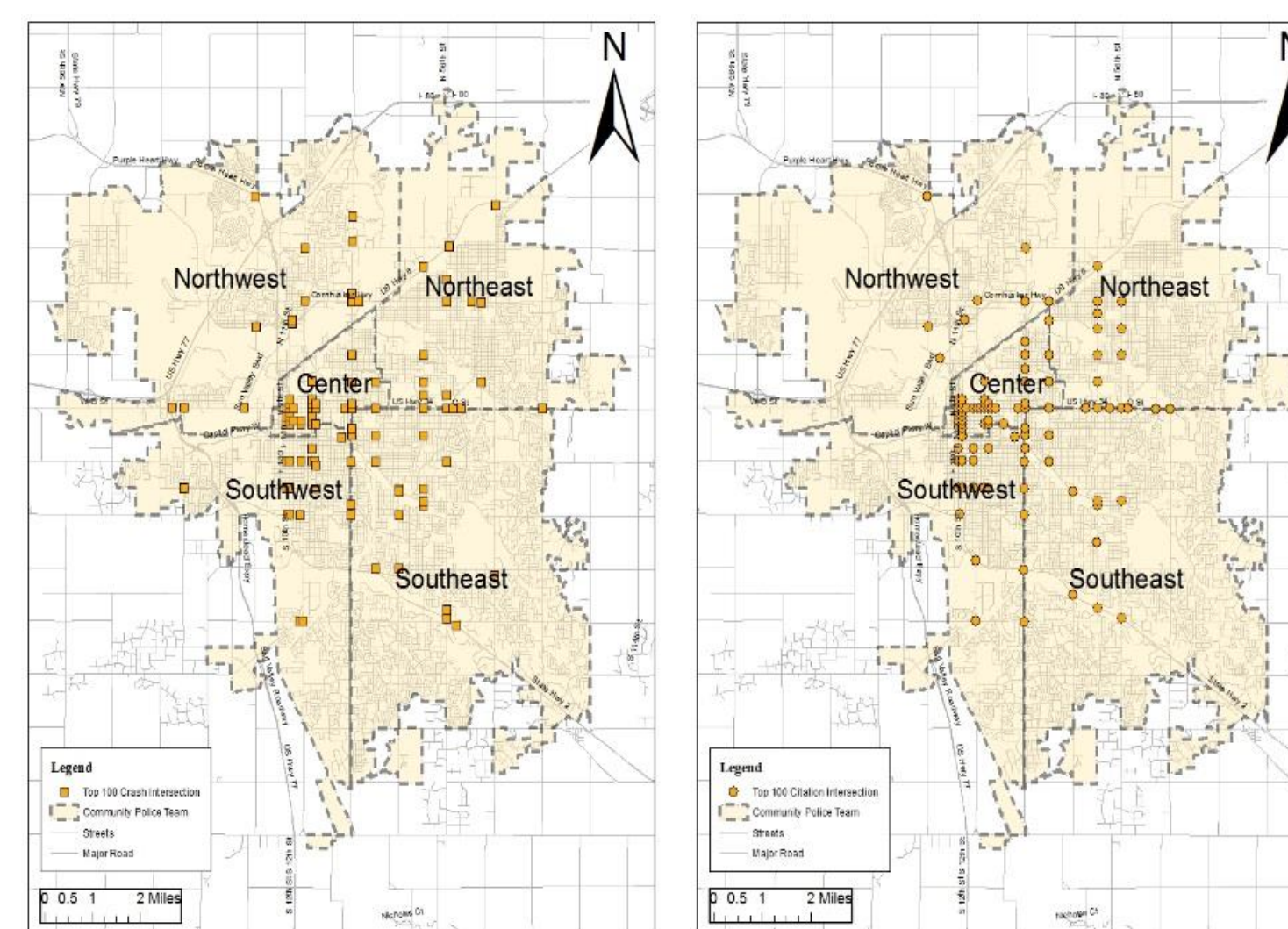
Results of Moran's I:
➢ Two Moran's I values are nearly 0. Thus, no global clustering or dispersion exists.

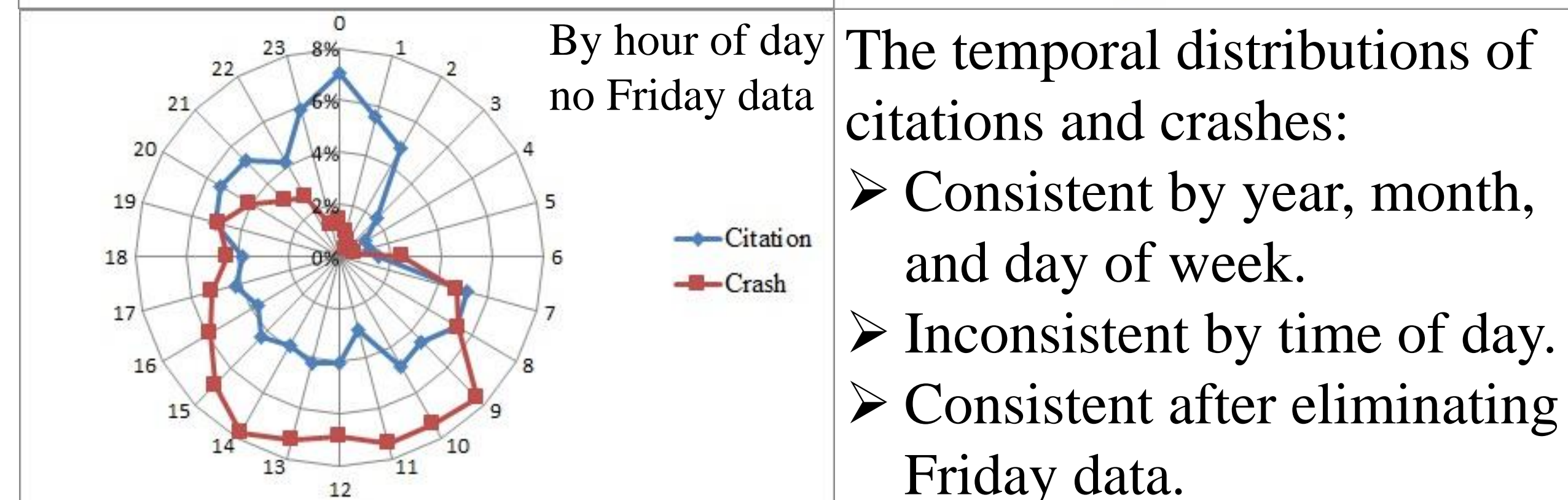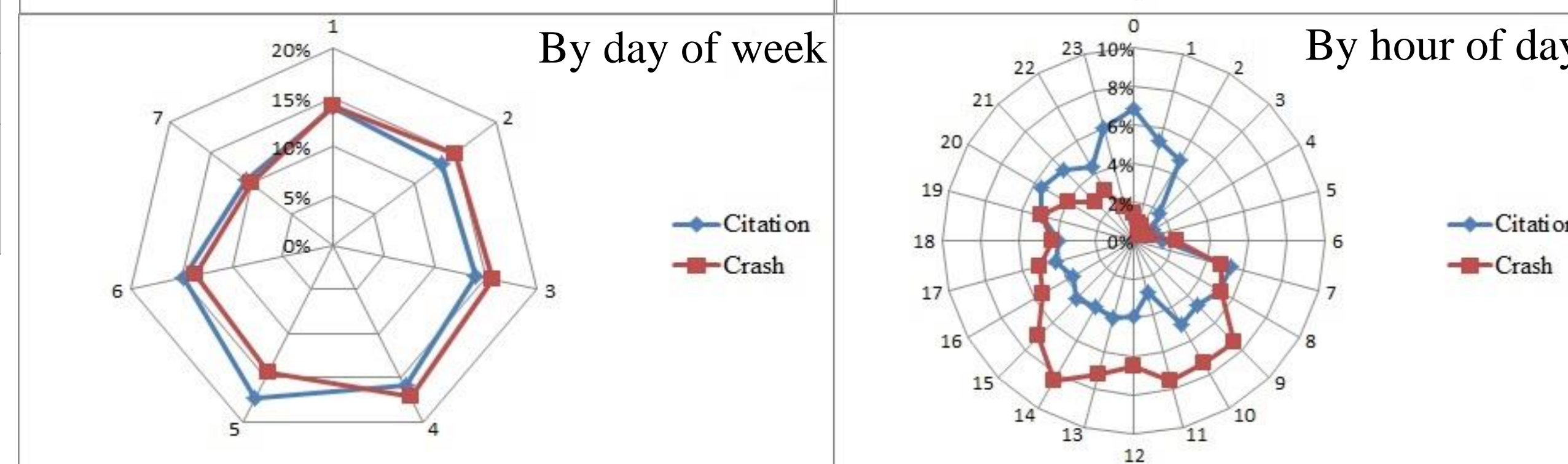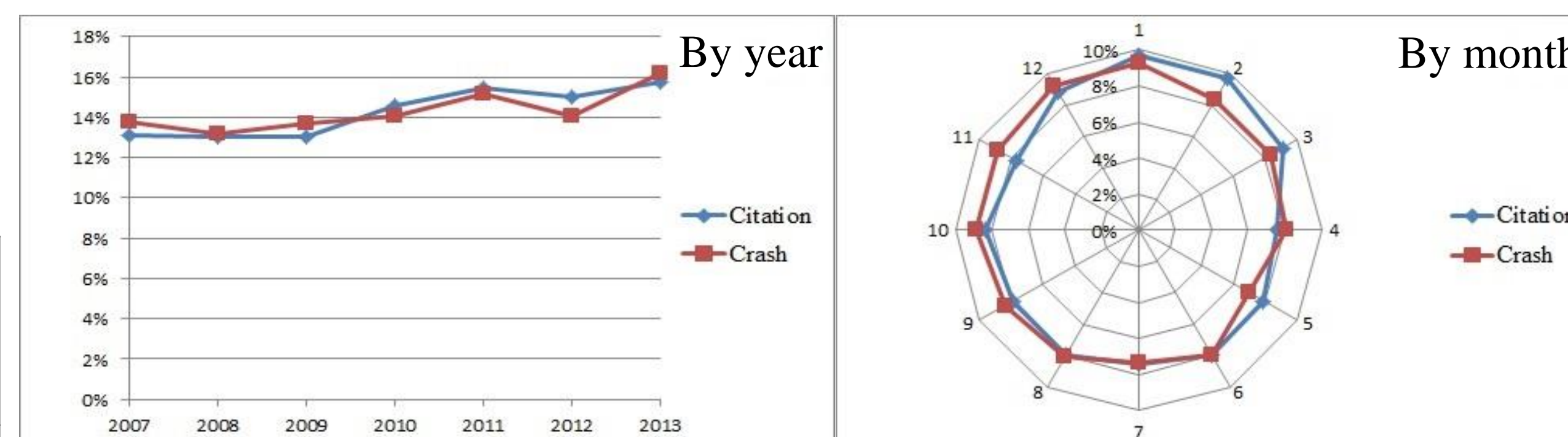**Bivariate LISA cluster map with the variable of interest being crash**

**Top 100 crash and citation intersections**

Results of LISA:
➢ 92 high-high clusters, 290 low-high outliers, and 27 high-low clusters.
➢ RLR law enforcement may be adjusted in these locations, especially at the high-low locations.

Data Analysis – Temporal Analysis

The temporal distributions of citations and crashes:
➢ Consistent by year, month, and day of week.
➢ Inconsistent by time of day.
➢ Consistent after eliminating Friday data.

Data Analysis – Spatio - Temporal Analysis
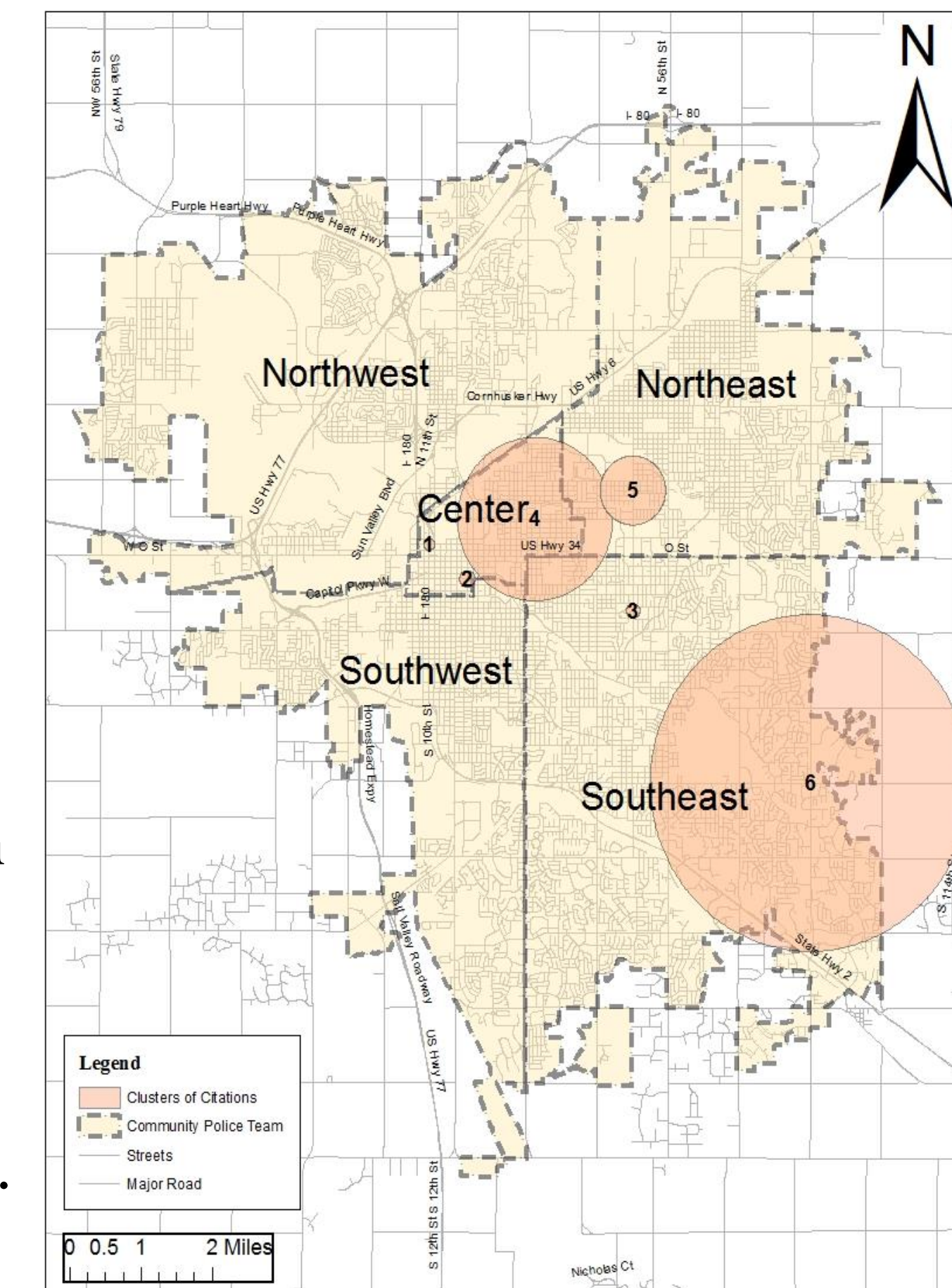
Cluster	Radius (km)	Time frame
1	0.12	7:00 to 15:00
2	0.18	7:00 to 8:00
3	0	14:00 to 15:00
4	1.75	17:00 to 21:00
5	0.74	1:00 to 4:00
6	3.61	9:00 to 16:00

Statistically significant spatio-temporal (ST) clusters of citations

The ST distributions of citations and crashes:
➢ Crashes have no ST clusters.
➢ The ST clusters of citations partially overlap with the results of spatial and temporal analysis.
➢ Police may adjust their deployment in RLR enforcement.

Conclusions

➢ The distributions of RLR citations and crashes are not consistent in space and time.
➢ The current RLR law enforcement may be adjusted by the research results. However, the detailed investigation is strongly recommended before any adjustment.

Acknowledgements